SCIENCE.—SUPPLEMENT.

FRIDAY, NOVEMBER 27, 1885.

A NEED FOR A CAREFUL STUDY OF THE HISTORY OF CHINA.

WHEN it is remembered that the Chinese writers have hardly any conception of history in our sense of the term, that their most renowned historians give us little more than annals or chronicles, the dead and fleshless bones of history, we cannot complain that Fries's history of China, which is a condensed translation of Chinese writers, is not a rich and flowing narrative. It is simply a bald outline of the succession of sovereigns and dynasties, of the tricks and vices by which the throne was often won, of the military achievements of the rulers, and of the divisions and reunions which the territory of the empire has undergone. Of the condition of the people through the long period of their national existence, of their progress in arts and learning, of the philosophy of their institutions, of the solution of the problem of their survival of all the destructive influences which have wrecked every other nation, we hear nothing in this book, because the Chinese chronicler has said nothing of all these to the translater and compiler.

It is greatly to be desired that some competent scholar should make a careful study of Chinese political history and institutions, in the spirit in which Sir Henry Maine has studied the institutions and laws of ancient and mediaeval Europe and of India. There is reason to hope that not a little light could be thrown by such study on certain European institutions and traditions. Why should not the careful investigation of Chinese feudalism, which had run its course, and perished centuries before feudalism sprang up in Europe, yield results most interesting to the student of European feudalism? Why should not the careful study of the village organization in China, which probably has scarcely changed for three thousand years, add to the light which Mr. Maine's study of the village communities in India has thrown upon the primitive life of Europe? Who that has observed the common responsibility of the dwellers in a Chinese street, for the preservation of order in that street, has not been reminded of the old Saxon frank-pledge? Is the resemblance accidental, or is there an historical basis for it? The day cannot be far distant when western scholars will be giving to such subjects the attention they deserve. A profound knowledge of the Chinese language, exhaustless patience in ransacking the voluminous literature of China, and a thorough investigation of existing usages and laws in towns and villages of China, will be necessary for the successful prosecution of such work. But the facilities for mastering the language are now so great, and the opportunities for coming into close contact with Chinese life and thought are so rapidly increasing, that the younger scholars need not despair of accomplishing what has hitherto been impossible, but what may prove a most valuable contribution to the history of institutions.

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Abriss der geschichte China's seit seiner entstehung. Nach chinesischen quellen übersetzt und bearbeitet von Sigmund Ritter von Fries. Wien, *Frick*, 1884.

PRODUCTIVENESS.

THERE are many problems of a biological nature which, when applied to man in particular, assume an economic aspect. The statistics of the birth and death rates, of the growth of populations, of the number of children per marriage, and so on, belong to the biologist as well as to the political economist. The interest of the former is a little broader, because similar statistics for other animal species would have considerable value for him, while the economist would hardly care to spend time on this side of the question. Owing to this close relation of these biological and economic questions, it sometimes happens that the latter tries to answer the question about which the biologist is the judge, or *vice versa*. The last French census has given the economists a chance to reproach France with the charge of sterility, implying as it does that the sterility is the result of voluntary determination. M. Gaetau Delaunay[1] denies the justness of this reproach, and holds that the decrease in productiveness observed in the French people is a biological fact which must be explained by an examination of the natural conditions which control the production of offspring.

The lower species of plants and animals are more fertile than the higher. The female of the white ant lays 60 eggs per minute; a queen bee deposits 5,000 to 6,000 eggs annually. In vertebrates, fecundity diminishes as we rise from fishes to reptiles, from reptiles to birds, from birds to

[1] *Revue scientifique*, Oct. 3, 10, 1885. The editor of the *Revue scientifique* records in a footnote the death of M. Delaunay just as these papers went to press.

mammals. In a general way there is an inverse relation between the number of offspring and the size of the animal. (This may indicate why many of the mammoths are extinct.) While the lower species is more productive, the life of the individual is much shorter. This inverse ratio between the productiveness of the species and the longevity of the individual is a very fortunate arrangement; for, according to the estimation of M. Quatrefages, two successive generations of the offspring of a single plant-louse would cover eight acres, and the fish would fill the sea in a man's lifetime. Again: in the lower organisms the mortality is great; very many die before reaching maturity.

Inferior races are more prolific than superior races. The finest varieties of fruits bear least. Dog-fanciers testify that the most intelligent varieties have the fewest young ones. In man the lower races[1] are most productive. Among the Kafirs twins are said to be as common as single births, and triplets frequently occur. The black race is more fertile than the white. One authority gives 2.05 children for each white woman, and 2.42 for the colored. The Chinese occupy less than 1-300 of the surface of the globe, and yet their population includes nearly 1-3 of the human race. Among European nations, Russia and Spain are the most productive, Switzerland and France the least.

The inference to be drawn is not that in France the duties of maternity are shirked, but that the natural effect of a high civilization shows itself in this diminution of fertility. Nor is it a mark of decadence, for the Swiss nation shows a similar phenomenon. Again: while Spain and Italy show a higher productiveness, the longevity is lower. The average life is thirty-one years: in France it is forty years. France has more persons from fifty to sixty years of age than other countries. What is lost in quantity is gained in quality. The number of children per marriage has been declining: from 1800 to 1815 it was 3.9; 1815 to 1830, 3.73; 1874 to 1878, 3.04; but the mean life has increased. From 1810 to 1815 it was 31 years 3 months; 1820 to 1830, 32 years 2 months; 1861 to 1865, 37 years 6 months. In other countries of advanced civilization, the fertility, though still high, is on the decrease. England, Austria, Prussia, — all show the same state of affairs. These countries will in time exhibit the same loss of fecundity as is shown in France now. An additional refutation of the charge of the voluntary origin of this sterility is the fact that the ratio of marriages to the population has not been decreasing in France, and is now as high as elsewhere.

The young are more fertile than the old. Young vines give a large harvest, but the grapes are poor. Buffon states that at 18 women are more productive than at 30; according to an English authority, fertility increases up to 25 or 30 years, and then diminishes. To-day the French woman is 24½ years old, the man 29 years 7 months, at the time of marriage. In the eighteenth century they were 19 and 25 years respectively. The result is that to-day the fertility is less; but the quality of the offspring is better.

Within certain limits a weak temperament favors fertility. Domesticated animals have more offspring than wild ones. A vigorous active life apparently does not favor longevity. Tailors and shoemakers have more children than blacksmiths. The ancient athletes and the modern acrobats seldom have children. War kills off the strongest men, and leaves the weak to propagate the race; hence the birth-rate increases. From 1811 to 1815 it was 3.49, but from 1816 to 1820 it was 4.08 in France.

Brain-workers and intelligent people have fewer children than others. Sixty-one married professors of the medical faculties of Paris, Lyons, and Bordeaux, had only 1.78 children to each marriage. The mortality among these children, however, was very low; and so, in general, the offspring of these more evolved, less fertile classes is of a stronger, larger, and higher kind. *Fortes creantur a fortibus.*

There probably is a limit below which propagation is impossible; but there is surely a limit of too high nurture, above which reproduction is lowered; and the maximum fecundity is a state nearer to the want than to the excess of good nurture.

In the more advanced races a famine increases the birth-rate. The poor are notoriously prolific of offspring. But the offspring of the wealthy classes is longer lived. Finally, as to climate: the fertility is higher in warm countries, but the mortality is lower in the north than in the south.

Productiveness is a characteristic of the lower species and races; of the younger individuals; of the weak, both bodily and mentally. There is throughout an inverse relation between quality and quantity of offspring. All circumstances that modify fecundity in plants and animals are equally active in man, and hence in the French people as well. The diminution in fertility observable in other European nations as well as in the French is a physiological and not an economic

[1] The Hottentots, Fuegians, etc., are really no exceptions, as these races are starved, and naturally tend to extinction.

fact: it is determined by natural conditions, and not by the voluntary decision of individuals.

J. J.

A SUGGESTION FROM MODERN EMBRYOLOGY.

ONE of the obstacles which proved to be a difficulty of considerable weight to Darwin in his application of the descent theory was the sudden appearance of a highly developed fauna in the Silurian age. This difficulty has not decreased, but has rather increased with the further knowledge of that fauna. The primordial fauna, as shown by the fossils of the Silurian rocks, was not what naturalists would have assumed had they been called upon to construct this fauna from *a priori* grounds. Instead of a few simple generalized forms, these early rocks showed evidence of a highly diversified fauna. In the Silurian rocks are represented all of the great divisions of the animal kingdom, including even the vertebrates. Moreover, of the smaller divisions, a sufficient number are here represented to cause considerable surprise. About five-sixths of the orders now existing, nearly an equal proportion of sub-orders, a great many families and some genera of to-day are found in these earliest rocks. It is indeed remarkable to find such a very large number of existing groups represented in the earliest fauna of which we have any knowledge. It is true that the Silurian age lasted a long time, and that in the lower Silurian the fauna is not quite so diverse as above indicated; but even here it is sufficiently diverse to be surprising. When the history of vertebrates since that time is compared with the history of other groups, the contrast is very striking. They have had time enough to develop from the very lowest forms — which we judge lived in the Silurian times — into the present highly diversified groups. But with all other groups of animals the advance has been comparatively small. It must be assumed, to reconcile these facts with evolution, that enough time elapsed between the beginning of life on the world and the beginning of the Silurian to develop all of the sub-kingdoms except the vertebrates to a high degree of differentiation. And, when the great amount of time which it has required to develop the vertebrates is taken into consideration, the amount of lost time necessary to assume previous to the Silurian seems too great to be credible.

It will, of course, never be possible to reconcile the Silurian fauna with evolution without the assumption of a long lost period of this character. But certain general results from modern embryology are in this connection suggestive, and indicate that the difficulty is not so great as has been sometimes conceived. For modern embryology is teaching us that our various sub-kingdoms are all direct modifications of the most primitive multicellular animal. Using embryology as a guide in interpreting animal history, naturalists have been continually shortening this history, particularly at the bottom. From the time when Haeckel traced the genealogy of man through twenty-one stages, these stages have one by one been dropped by naturalists, with the result of making the history a much more direct one. Finally, the recent theories of Sedgwick, and others who follow him wholly or partially, would make the history of all animals much shorter by showing that all the sub-kingdoms may be regarded as resulting directly from modifications of the gastrula by slight changes in its shape. We once derived the worms from the coelenterates, the annelids from the lower worms, and the vertebrates from the annelids; but now all of these groups are derived directly from the gastrula itself. This theory of Sedgwick is receiving support in some form from many sources — at least, so far as concerns this feature of it. There is certainly a tendency to-day to look upon a greater and greater number of types as direct modifications of the original animal represented by the gastrula stage. Coelenterates, polyzoa, brachiopods, mollusks, annelids, and vertebrates have all been shown to be derivable from the gastrula by simple direct modifications.

Now, we must remember that slight variations at the bottom of a diverging series produce much greater effects than variations higher up. When a tree is first sprouting, differences in the direction of its buds determine the shape of the future tree; for these early buds become the great branches, and the slightest difference in their direction is enough to cause a wide separation between them as growth goes on. After the tree has grown to a considerable size, its buds no longer produce great branches, but only small ones, or perhaps only twigs. Growth cannot now change the general shape of the tree, but only increase the profusion of small branches, twigs, and leaves. That such a relation represents the history of the various groups of the animal kingdom is unquestionably the teaching of modern embryology.

The significance of this result in enabling us to understand the fauna of the Silurian rocks is evident enough. It not only shortens the time necessary to be assumed prior to the Silurian, but it also enables us, partially at least, to understand the presence at this early period of such a large number of our present existing types. For the protozoan to develop into the first multicellular animal, represented by the gastrula, must have